Space Weather Technical Forecast

Issued on Friday, 07 June 2024 at 12:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Isolated M-flares remain likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the last 24 hours with two M flares, a M6.1 at 06/1506 UTC associated with AR3697, and a M4.0 at 07/0913 UTC from the as yet unnumbered region on the southeastern limb. There are nine visible sunspot regions. AR3697 in the southwest, remains relatively unchanged but continues to display a complex magnetic structure both within and above the spot. AR3703 in the southwest, has a persistent small delta within its trailer, but has remained largely inactive with a slight decrease in overall size. Both recently numbered spots in the southeast are showing signs of growth and complexification. The as yet unnumbered region rotating into view has had a preliminary classification assigned, appearing as a potentially large and complex region, but will be fully assessed in coming days as it rotates fully into the disk. All other regions remain smaller and simple at present.

There were no Earth-directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, have been at background, perhaps with a signal for a late weak transient. Speeds were slow/ambient, ranging 340-400 km/s, until 07/1055 UTC when the became slightly elevated between 400-440 km/s. Density was below average. The Interplanetary Magnetic Field (IMF), Bt, was at weak, at 7nT or below, for much of the period until 07/1055 UTC when it became moderate at 8/9nT. The north-south component varied weakly between +4 and -6nT, becoming increasingly negative (southward) until 07/1055 UTC when it became moderately negative -7/-8nT. Phi angle was negative (toward the Sun) until 07/0242 UTC when it began to fluctuate between positive and negative. Geomagnetic activity was Quiet to Unsettled (Kp 0-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels with the associated 24-hour fluence well below Active. Observed fluence at 07/0000 UTC was 1.49e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Occasional Moderate activity is likely with isolated M-flares and a slight chance of X-class flares. These most likely from AR3697, or perhaps new region/s on the southeast limb.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. The next potential enhancement is likely to be from CH42/+, which could bring slightly elevated or possibly elevated wind speeds later on day 2 or perhaps more likely on day 3 (08-09 Jun) onwards, although this is low confidence. Overall, Quiet geomagnetic activity is expected, increasing to give a spell of Unsettled with Active intervals with any coronal hole fast wind onset.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above the S1/Minor Radiation Storm threshold throughout given any notable flares. High energy electron flux is forecast to persist at background levels, with the associated 24 hour fluence forecast to remain below the Active

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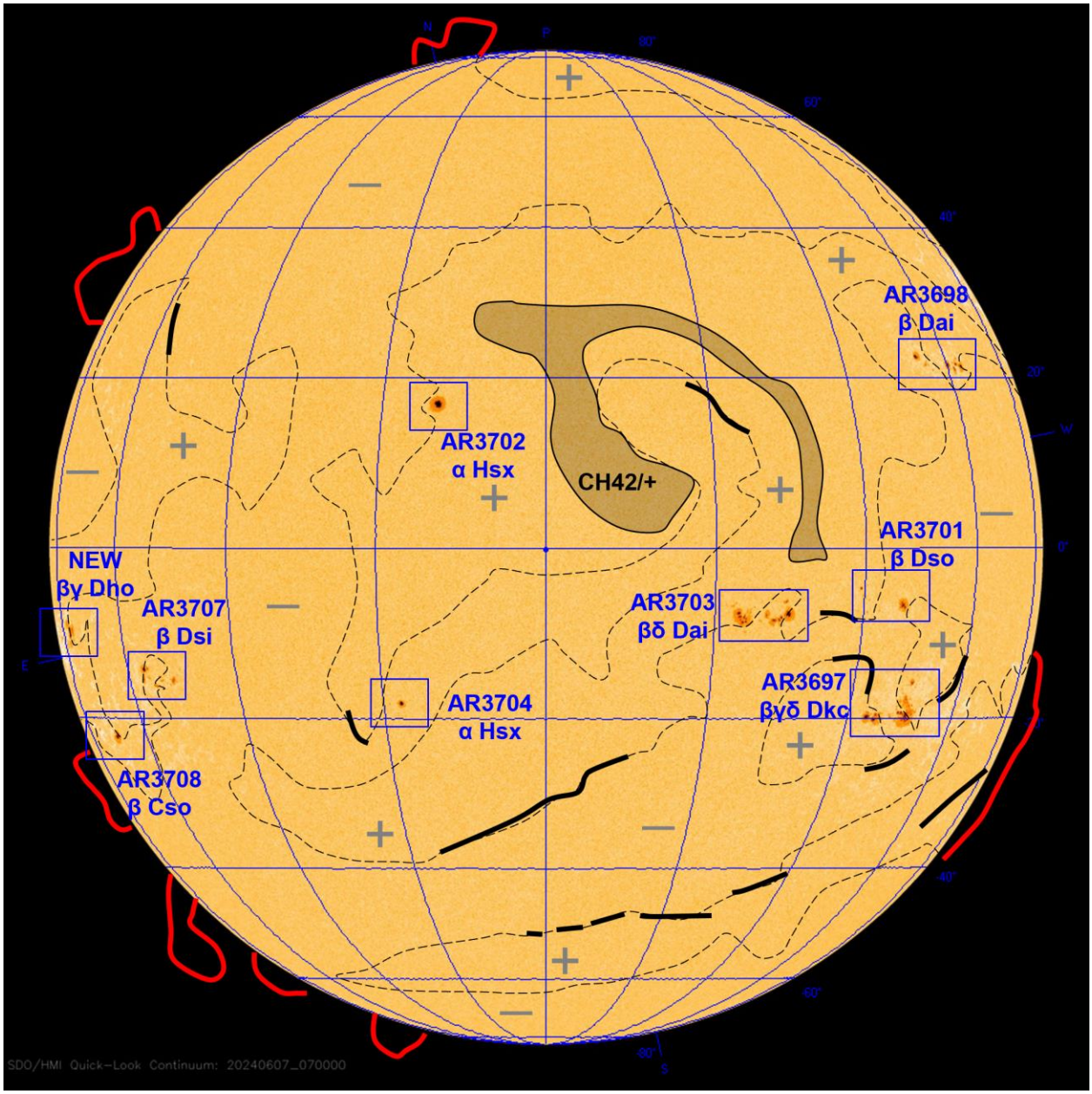
threshold.

Figure 1. Solar Analysis Valid 07/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

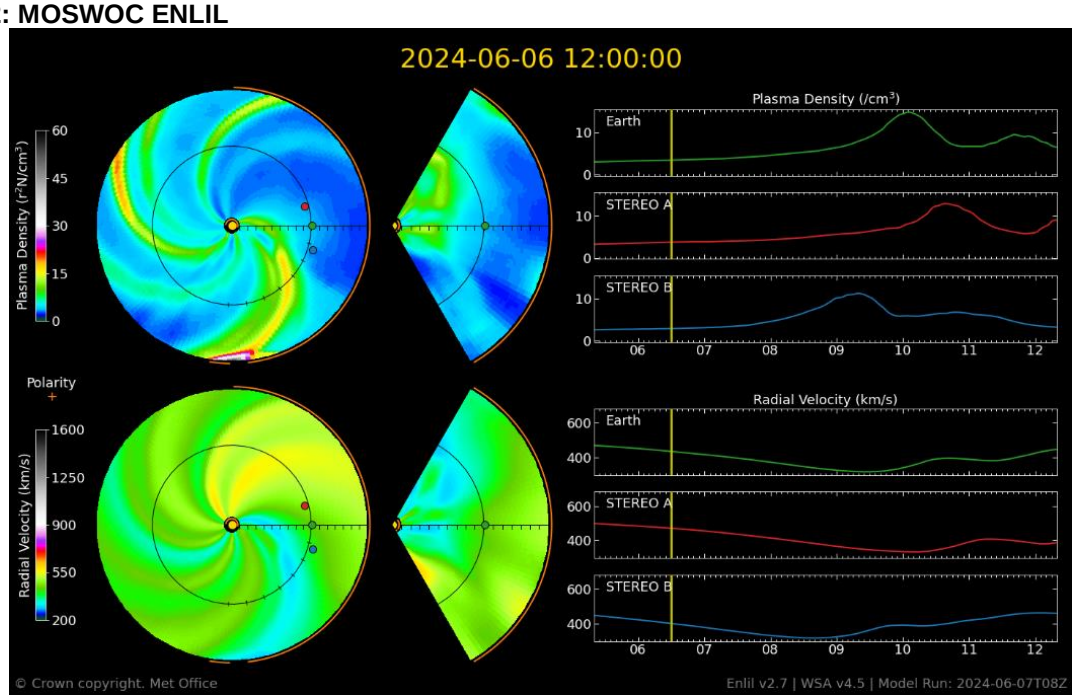
There are currently no Earth-directed CMEs expected.

Solar winds have been at background levels. The next potential enhancement is most likely to be from the elongated CH42/+ currently just west of the north-centre disc, which could bring slightly elevated or possibly elevated wind speeds later on day 2 (08 Jun) or perhaps more likely into day 3 (09 Jun) onwards. This is low confidence, however, due to limited enhancement currently indicated in MOSWOC ENLIL model output and the lack of evidence from the previous rotation, which was dominated by the arrival of fast CMEs. Any geomagnetic response is expected to be limited however.

Overall, generally Quiet geomagnetic activity is expected, but with the potential for spells of Unsettled to Active conditions from any coronal hole fast wind onset, and a slight chance of G1/Minor Storms on days 2-4 (08-10 Jun). This as a potential result of a stronger than expected fast wind onset or CME enhancement should we see CME activity in the near term, with multiple sunspots and filaments now in a potentially Earth effective location.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



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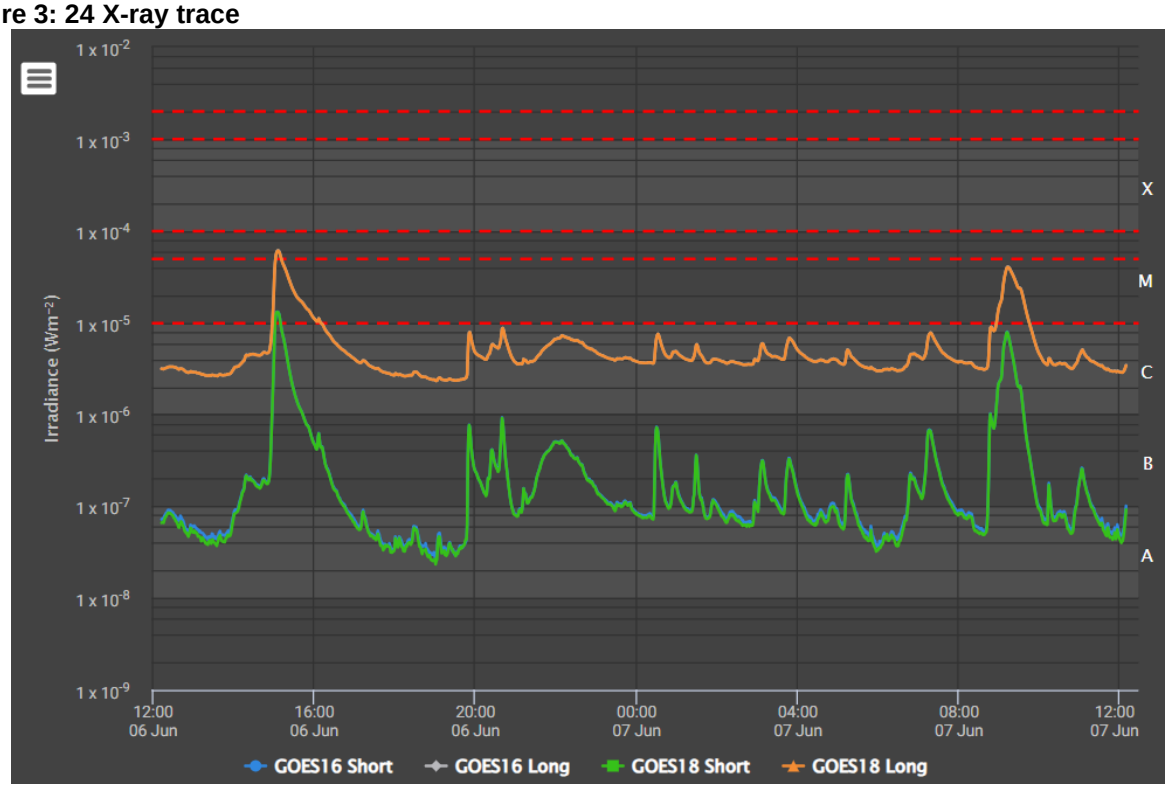
Radio Blackouts - X-Ray Flares:

Further periods of Moderate activity are likely with an ongoing chance of M-flares, primarily from AR3697 in the southwest or the new region/s rotating onto the southeast disc. There remains a slight chance of isolated X-class flares throughout pending further developments.

There are nine visible sunspot regions, one of which is unnumbered in the southeast. AR3697 in the southwest, remains relatively unchanged but continues to display a complex magnetic structure both within and above the spot, maintaining a significant flare risk. AR3703 in the southwest, has a persistent small delta within its trailer, but has remained largely inactive with a slight decrease in overall size. Both recently numbered spots in the southeast are showing signs of growth and complexification. The as yet unnumbered region rotating into view has had a preliminary classification assigned, appearing as a potentially large and complex region, but will be fully assessed in coming days as it rotates fully into the disk. All other regions remain smaller and simple at present.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: 24 X-ray trace



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels. AR3697 is now much reduced compared to its previously active phases, but still maintains the potential for further flares, albeit most likely at M-class. Alongside the other active regions, the majority of which are in the western disc, this gives a slight chance of proton flux exceeding the S1/Minor Radiation storm level though the period, even as they begin to rotate away beyond the western limb by day 4 (10 Jun).

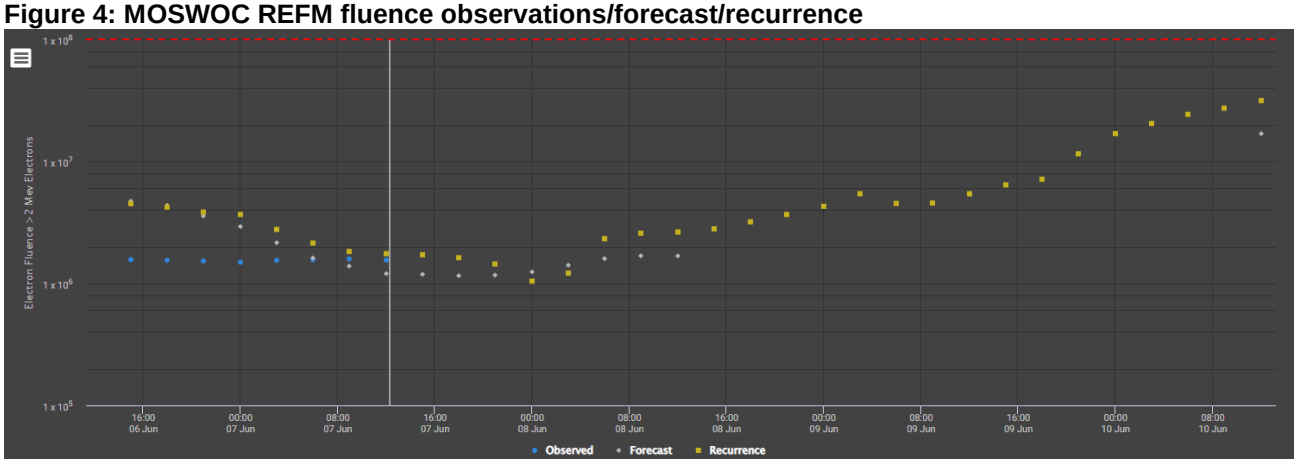
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux, as observed by GOES-16, is expected to persist at mainly background levels, with no notable sources of potential enhancement currently anticipated. The associated 24 hour electron fluence is expected to remain well below the Active level with MOSWOC REFM output viewed as generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM fluence observations/forecast/recurrence



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